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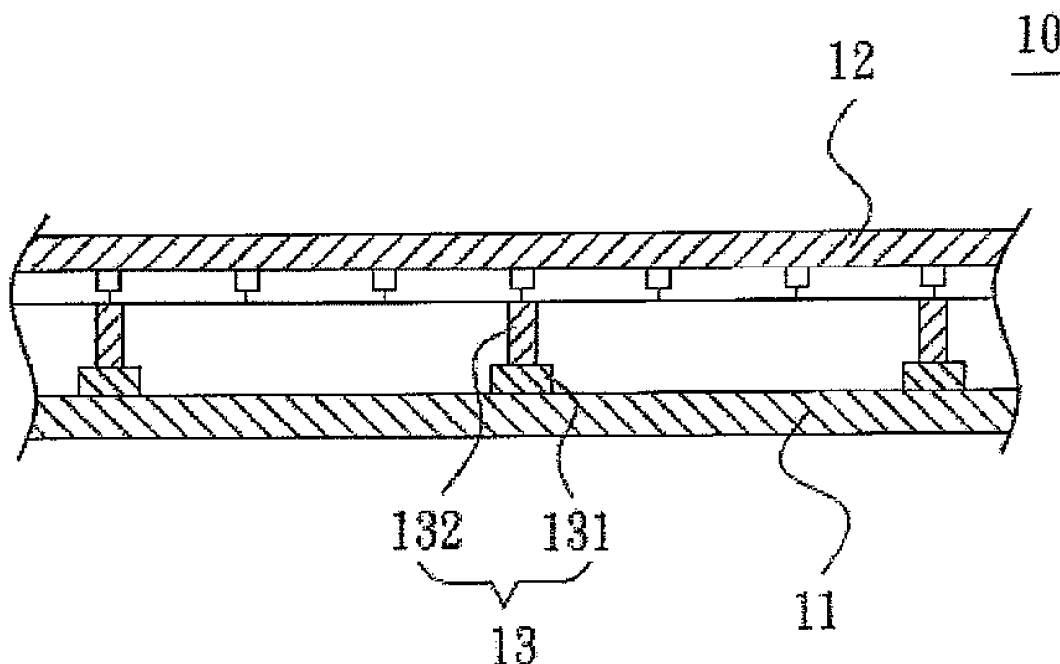
(19) **United States**(12) **Patent Application Publication**
Chen et al.(10) **Pub. No.: US 2013/0010238 A1**(43) **Pub. Date: Jan. 10, 2013**(54) **LIQUID CRYSTAL PANEL AND SPACER
STRUCTURE THEREOF****Publication Classification**(75) Inventors: **Ya-hui Chen**, Shenzhen (CN);
Tsunglung Chang, Shenzhen (CN)(51) **Int. Cl.**
G02F 1/1335 (2006.01)(52) **U.S. Cl.** **349/106**(73) Assignee: **SHENZHEN CHINA STAR
OPTOELECTRONICS
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Guangdong (CN)(57) **ABSTRACT**(21) Appl. No.: **13/264,145**(22) PCT Filed: **Aug. 4, 2011**(86) PCT No.: **PCT/CN2011/078000**

§ 371 (c)(1),

(2), (4) Date: **Oct. 12, 2011**(30) **Foreign Application Priority Data**

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The present invention discloses a liquid crystal panel and a spacer structure thereof. The liquid crystal panel has: an array substrate, a color filter substrate, and a plurality of spacer structures sandwiched between the array substrate and the color filter substrate. Each of the spacer structures has: a first spacer disposed on an upper surface of the array substrate; and a second spacer disposed on a lower surface of the color filter substrate. The second spacer is correspondingly abutted against the first spacer. Thus, when the liquid crystal panel is impacted by external force, the first spacer and the second spacer can keep a tight abutment therebetween, so as to ensure the display quality of the liquid crystal panel.



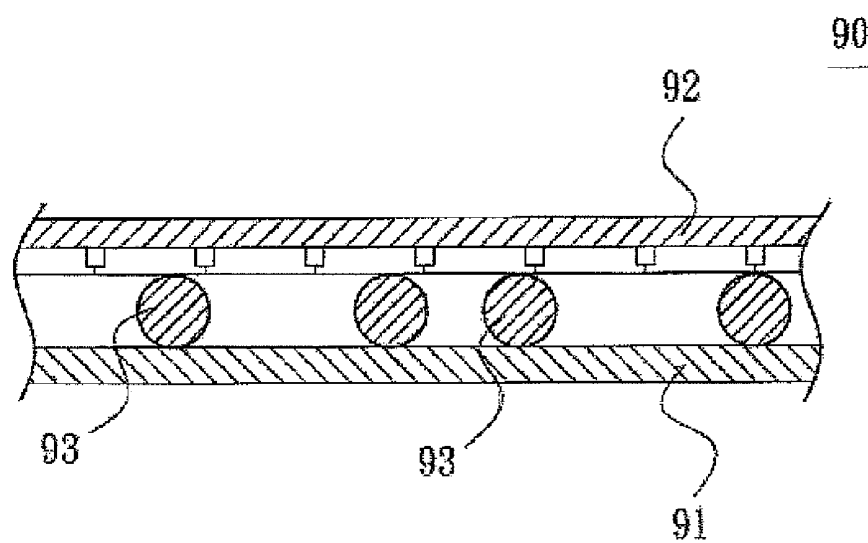


FIG. 1
PRIOR ART

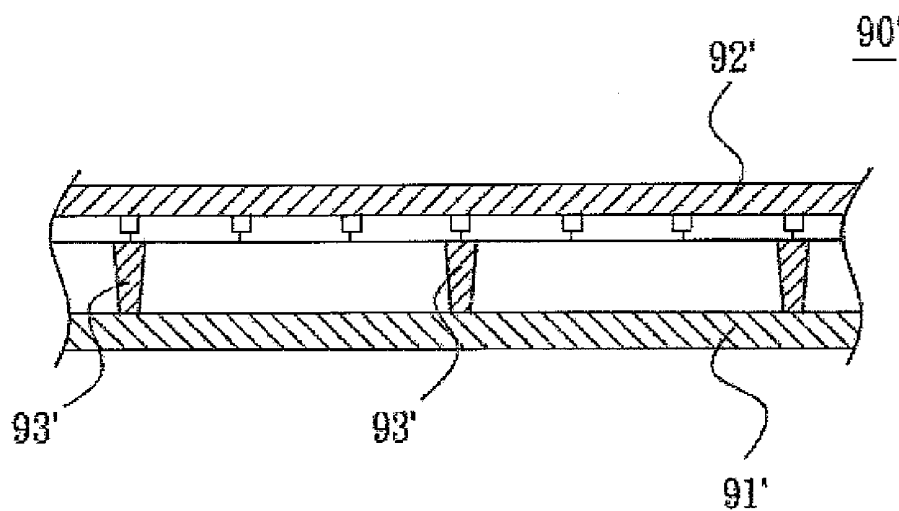


FIG. 2
PRIOR ART

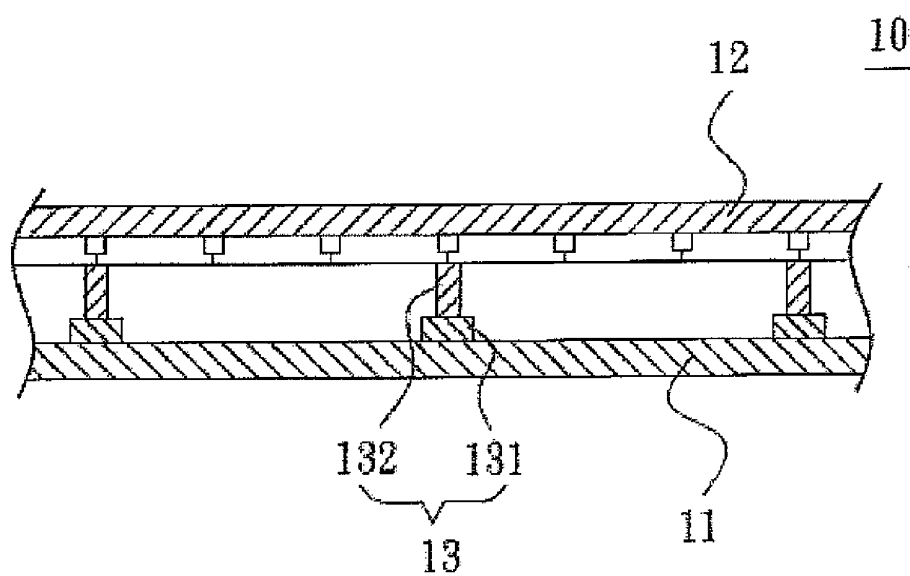


FIG.3

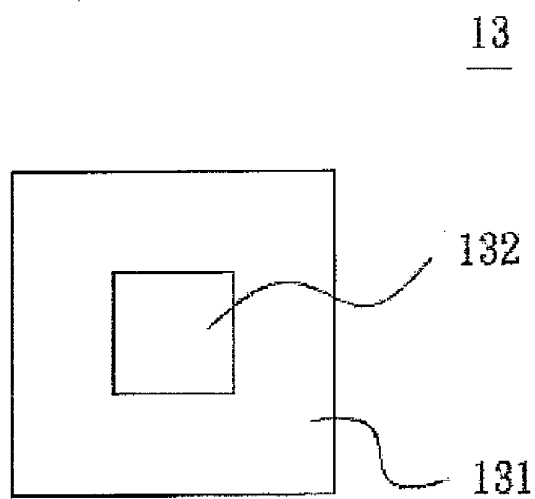


FIG.4

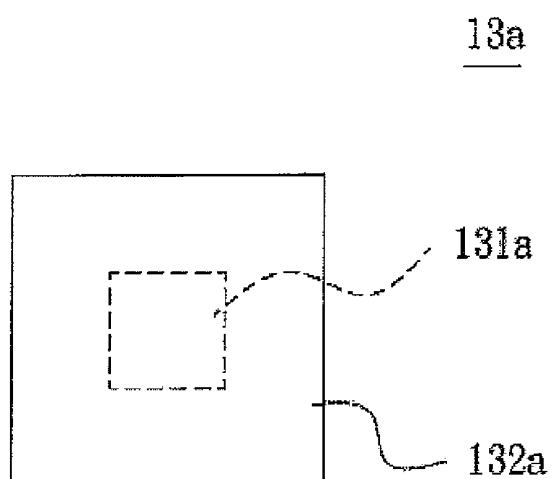


FIG.5

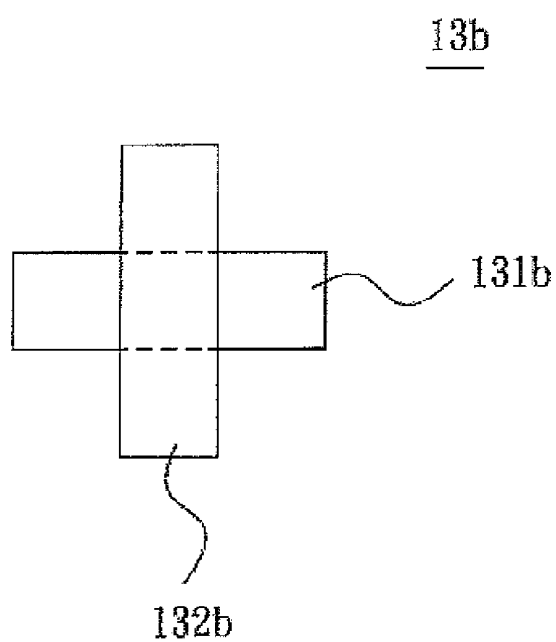


FIG.6

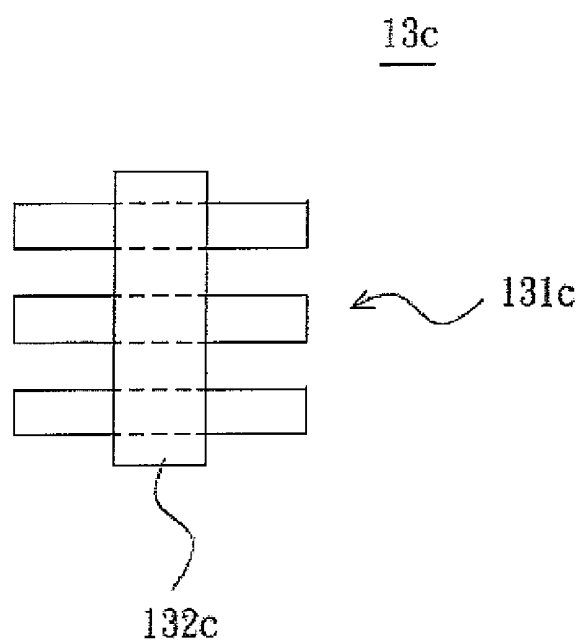


FIG. 7

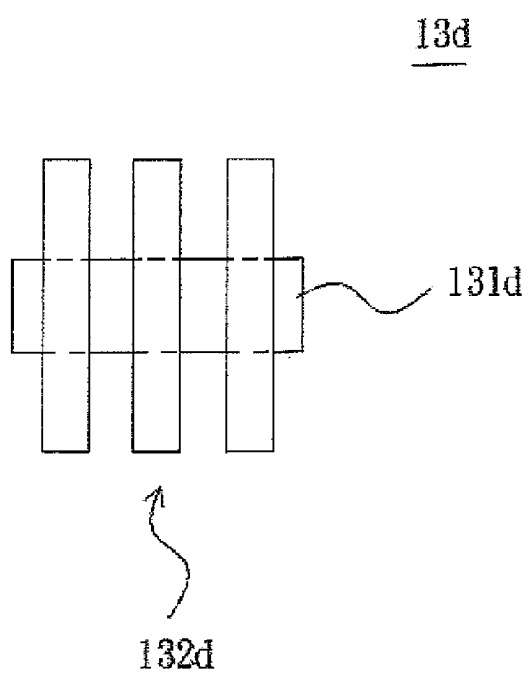


FIG. 8

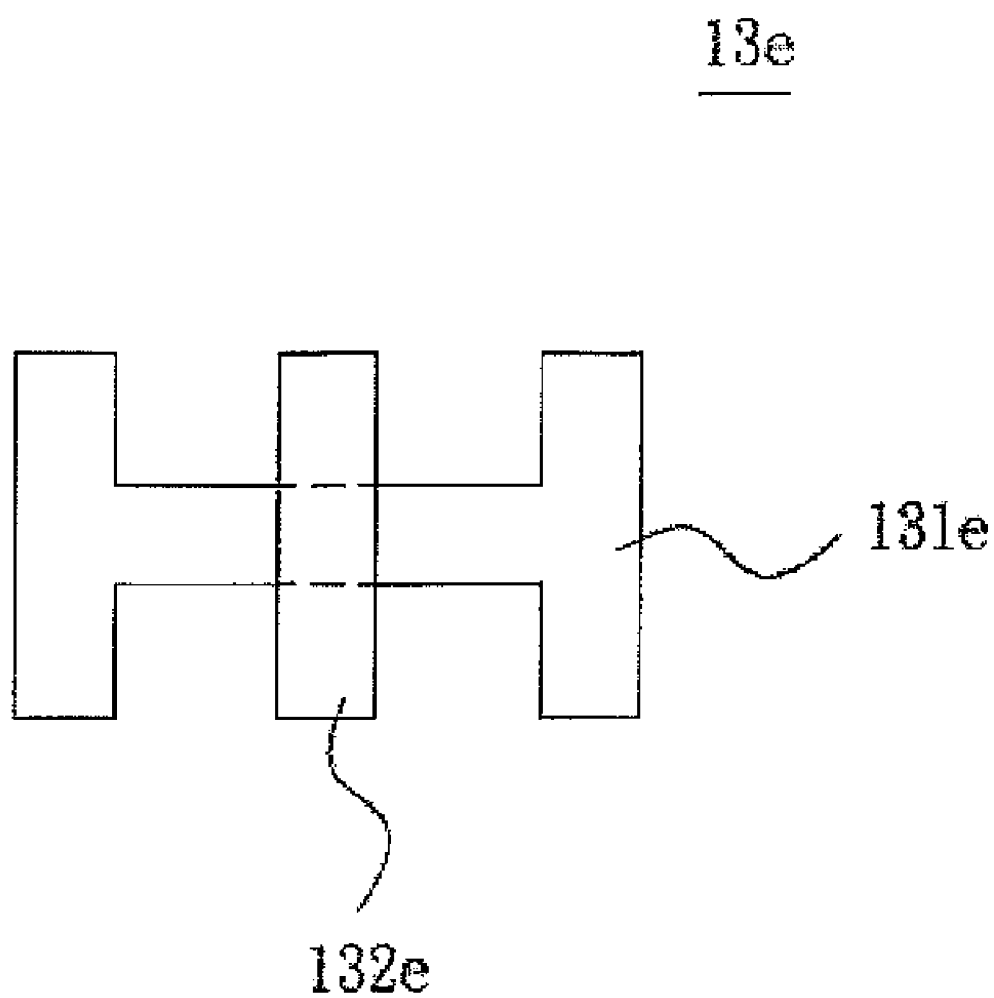


FIG. 9

LIQUID CRYSTAL PANEL AND SPACER STRUCTURE THEREOF

FIELD OF THE INVENTION

[0001] The present invention relates to a display panel, and more particularly to a liquid crystal panel and a spacer structure thereof.

BACKGROUND OF THE INVENTION

[0002] A liquid crystal display (LCD) is a type of flat panel display (FPD) which displays images by the property of the liquid crystal material. In comparison with other display devices, the LCD has the advantages in lightweight, compactness, low driving voltage and low power consumption, and thus has already become the mainstream product in the whole consumer market. In a traditional process of LCD panel, it comprises a front-end array process, a mid-end cell process and a back-end modulation process. The front-end array process is used to produce thin-film transistor (TFT) substrates (also called array substrates) and color filter (CF) substrates; the mid-end cell process is used to combine the TFT substrate with the CF substrate, then fill liquid crystal into a space therebetween, and cut to form panels with a suitable product size; and the back-end modulation process is used to execute an installation process of the combined panel, a backlight module, a panel driver circuit, an outer frame, etc. Furthermore, in the mid-end cell process, the TFT substrate must be aligned and combined with the CF substrate for filling the liquid crystal into the space between the TFT substrate and the CF substrate.

[0003] Referring now to FIG. 1, a cross-sectional view of a traditional liquid crystal panel is illustrated in FIG. 1. It should be noted that the figure has omitted some components unrelated to the present description based on explanation convenience, so that the figure is only a simplified schematic view. As shown in FIG. 1, a traditional liquid crystal panel 90 is constructed by stacking a CF substrate 92 on an array substrate 91, wherein a plurality of spherical spacers 93 are dispersedly distributed between the array substrate 91 and the CF substrate 92. The spherical spacers 93 can maintain a fixed distance between the array substrate 91 and the CF substrate 92 for receiving the liquid crystal (not-shown).

[0004] Referring now to FIG. 2, a cross-sectional view of another traditional liquid crystal panel is illustrated in FIG. 2 which is also shown by a simplified schematic manner. The liquid crystal panel 90' of FIG. 2 is substantially the same as the liquid crystal panel 90 of FIG. 1, i.e. constructed by stacking a CF substrate 92' on an array substrate 91', wherein a plurality of pillar-like spacers 93' are protruded from a lower surface of the CF substrate 92', and the pillar-like spacers 93' are formed by exposure and development during manufacturing the CF substrate 92'. The pillar-like spacers 93' can maintain a fixed distance between the array substrate 91' and the CF substrate 92' for receiving the liquid crystal (not-shown).

[0005] Although the configurations of the traditional spacers 93, 93' are different, the common purpose thereof is to evenly support the gap between the array substrate 91, 91' and the CF substrate 92, 92' of the liquid crystal panel 90, 90', in order to ensure the display quality of the liquid crystal panel 90, 90'. However, there are still some problems existing in the traditional spacers 93, 93', as follows: for the spherical spacers 93 of FIG. 1, during the manufacturing process of dispersing the spherical spacers 93, it is difficult to efficiently control

the distribution density of spraying process, so that the distribution density of the spherical spacers 93 is uneven to affect the evenness of the liquid crystal panel 90 and the display quality thereof. On the other hand, for the pillar-like spacers 93' of FIG. 2, when the liquid crystal panel 90' is impacted by external force, the pillar-like spacers 93' of the CF substrate 92' will be shifted in relation to the array substrate 91', and the displacement thereof can not be restored, resulting in permanently leaking light and thus affecting the display quality of the liquid crystal panel 90'.

[0006] As a result, it is necessary to provide a liquid crystal panel and a spacer structure thereof to solve the problems existing in the conventional technologies, as described above.

SUMMARY OF THE INVENTION

[0007] A primary object of the present invention is to provide a liquid crystal panel and a spacer structure thereof, which is used to solve the problems existing in the conventional technologies that the displacement of spacers affects the display quality of a liquid crystal panel.

[0008] To achieve the above object, the present invention provides a liquid crystal panel which comprises:

[0009] an array substrate having an upper surface provided with a plurality of first spacers; and

[0010] a color filter (CF) substrate disposed on the array substrate, wherein a lower surface of the CF substrate is provided with a plurality of second spacers, and each of the second spacers is correspondingly abutted against one of the first spacers.

[0011] To achieve the above object, the present invention further provides a spacer structure of a liquid crystal panel, which is sandwiched between an array substrate and a color filter (CF) substrate for correspondingly constructing a liquid crystal panel, wherein each of the spacer structure comprises:

[0012] a first spacer disposed on an upper surface of the array substrate; and

[0013] a second spacer disposed on a lower surface of the CF substrate, wherein the second spacer is correspondingly abutted against the first spacer.

[0014] In one embodiment of the present invention, the area of an end surface of the first spacer is not equal to the area of an end surface of the second spacer, and the end surface of the second spacer is abutted against the end surface of the first spacer.

[0015] In one embodiment of the present invention, the end surface of the first spacer is grid-like or strip-like, while the end surface of the second spacer is corresponding strip-like or grid-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

[0016] In one embodiment of the present invention, the end surface of the first spacer and the end surface of the second spacer are strip-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

[0017] In one embodiment of the present invention, the end surface of the first spacer is H-shape, and the end surface of the second spacer is strip-like, wherein the end surface of the second spacer is disposed on the end surface of the first spacer.

[0018] For the liquid crystal panel and the spacer according to the present invention, the first spacer and the second spacer commonly construct a spacer structure/assembly, so that the contact range between the end surface of the first spacer and

the end surface of the second spacer can be increased. When the liquid crystal panel is impacted by external force, the first spacer and the second spacer of the spacer structure can keep a tight abutment therebetween all the time, so as to ensure the display quality of the liquid crystal panel.

DESCRIPTION OF THE DRAWINGS

- [0019] FIG. 1 is a cross-sectional view of a traditional liquid crystal panel;
 [0020] FIG. 2 is a cross-sectional view of another traditional liquid crystal panel;
 [0021] FIG. 3 is a cross-sectional view of a liquid crystal panel according to a first embodiment of the present invention;
 [0022] FIG. 4 is a top view of a spacer structure according to the first embodiment of the present invention;
 [0023] FIG. 5 is a top view of a spacer structure according to a second embodiment of the present invention;
 [0024] FIG. 6 is a top view of a spacer structure according to a third embodiment of the present invention;
 [0025] FIG. 7 is a top view of a spacer structure according to a fourth embodiment of the present invention;
 [0026] FIG. 8 is a top view of a spacer structure according to a fifth embodiment of the present invention; and
 [0027] FIG. 9 is a top view of a spacer structure according to a sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings. Furthermore, directional terms described by the present invention, such as upper, lower, front, back, left, right, inner, outer, side, longitudinal/vertical, transverse/horizontal, and etc., are only directions by referring to the accompanying drawings, and thus the used directional terms are used to describe and understand the present invention, but the present invention is not limited thereto.

[0029] Referring now to FIGS. 3 and 4, a cross-sectional view of a liquid crystal panel according to a first embodiment of the present invention is illustrated in FIG. 3, and a top view of a spacer structure according to the first embodiment of the present invention is illustrated in FIG. 4. It should be noted that the figures have omitted some components unrelated to the present description based on explanation convenience, so that the figures are only simplified schematic views. As shown in FIG. 3, a liquid crystal panel 10 according to the first embodiment of the present invention comprises an array substrate 11 and a color filter (CF) substrate 12, wherein the alignment assembly of the liquid crystal panel 10 means the array substrate 11 and the CF substrate 12 are aligned and combined with each other, and then a liquid crystal material (not-shown) is filled into a space between the array substrate 11 and the CF substrate 12, so as to construct the liquid crystal panel 10.

[0030] In the preferred embodiment of the present invention, an upper surface of the array substrate 11 is provided with a plurality of first spacers 131, while a lower surface of the CF substrate 12 is provided with a plurality of protruded second spacers 132, wherein the CF substrate 12 is disposed and stacked on the array substrate 11. Each of the second

spacers 132 is correspondingly abutted against one of the first spacers 131, so as to construct a spacer structure 13, wherein the spacer structure 13 can maintain a fixed gap between the array substrate 11 and the CF substrate 12 when the CF substrate 12 is stacked on the array substrate 11.

[0031] Referring to FIG. 4, an end surface of the first spacer 131 and an end surface of the second spacer 132 are square, while the area of the end surface of the first spacer 131 is greater than that of the end surface of the second spacer 132. Moreover, the end surface of the second spacer 132 is abutted on the end surface of the first spacer 131. Thus, when the liquid crystal panel 10 is impacted by external force, the relative displacement between the first spacer 131 and the second spacer 132 may be changed. Because the area of the end surface of the first spacer 131 is greater than that of the end surface of the second spacer 132, the first spacer 131 still can keep being tightly abutting against the second spacer 132, so as to ensure the display quality of the liquid crystal panel 10.

[0032] In addition, according to present invention, the method of forming the first spacer 131 on the array substrate 11 and the second spacer 132 on the CF substrate 12 is not limited. The first spacer 131 can be a remaining portion of an etched insulation film and/or metal film during the manufacture process of the array substrate 11. The second spacer 132 can be formed by firstly coating material of the second spacer 132 and then carrying out some processes including pre-curing, exposure, development and post-curing after forming a transparent conductive film during the manufacture process of the CF substrate 92.

[0033] Furthermore, the first spacer 131 and the second spacer 132 are preferably pillar-like. Besides, in the embodiment, the end surface of the first spacer 131 and the end surface of the second spacer 132 are square, but the shape of the end surface of the first spacer 131 and the end surface of the second spacer 132 according to the present invention is not limited thereto, wherein the shape can be other configuration, such as various corresponding combination of rectangular, circular, oval, polygonal or other special shapes. In such a way, the purpose of the shape design is to keep tight abutment between the first spacer 131 and the second spacer 132.

[0034] Referring now to FIG. 5, a top view of a spacer structure of a liquid crystal panel according to a second embodiment of the present invention is illustrated in FIG. 5. The spacer structure 13a of the second embodiment of the present invention is substantially similar to the spacer structure 13 of the first embodiment, so that the second embodiment uses similar terms or numerals of the first embodiment. As shown, the difference between the first embodiment and the second embodiment is that the area of the end surface of the second spacer 132a is greater than that of the end surface of the first spacer 131a, and the end surface of the first spacer 131a is abutted on the end surface of the second spacer 132a. Thus, the spacer structure 13a still can keep the tight abutment between the first spacer 131a and the second spacer 132a, so as to ensure the display quality of the liquid crystal panel 10.

[0035] Referring now to FIG. 6, a top view of a spacer structure of a liquid crystal panel according to a third embodiment of the present invention is illustrated in FIG. 6. The spacer structure 13b of the third embodiment of the present invention is substantially similar to the spacer structure 13 of the first embodiment, so that the third embodiment uses simi-

lar terms or numerals of the first embodiment. As shown, the difference between the first embodiment and the third embodiment is that the end surface of the first spacer **131b** and the end surface of the second spacer **132b** are strip-like, while the end surface of the first spacer **131b** and the end surface of the second spacer **132b** are arranged to each other in a cross manner. Thus, when the liquid crystal panel **10** is impacted by external force, the tight abutment between the first spacer **131b** and the second spacer **132b** of the spacer structure **13b** can be still maintained, so as to ensure the display quality of the liquid crystal panel **10**.

[0036] Referring now to FIG. 7, a top view of a spacer structure of a liquid crystal panel according to a fourth embodiment of the present invention is illustrated in FIG. 7. The spacer structure **13c** of the fourth embodiment of the present invention is substantially similar to the spacer structure **13b** of the third embodiment, so that the fourth embodiment uses similar terms or numerals of the third embodiment. As shown, the difference between the third embodiment and the fourth embodiment is that the end surface of the first spacer **131c** is grid-like, and the end surface of the second spacer **132c** is strip-like. Meanwhile, the end surface of the first spacer **131c** and the end surface of the second spacer **132c** are arranged to each other in a cross manner, so as to increase the number of contact points between the first spacer **131c** and the second spacer **132c**. Thus, when the liquid crystal panel **10** is impacted by external force, the tight abutment between the first spacer **131c** and the second spacer **132c** of the spacer structure **13c** can be still maintained, so as to ensure the display quality of the liquid crystal panel **10**.

[0037] Referring now to FIG. 8, a top view of a spacer structure of a liquid crystal panel according to a fifth embodiment of the present invention is illustrated in FIG. 8. The spacer structure **13d** of the fifth embodiment of the present invention is substantially similar to the spacer structure **13b** of the third embodiment, so that the fifth embodiment uses similar terms or numerals of the third embodiment. As shown, the difference between the third embodiment and the fifth embodiment is that the end surface of the second spacer **132d** is grid-like, and the end surface of the first spacer **131d** is strip-like. Meanwhile, the end surface of the first spacer **131d** and the end surface of the second spacer **132d** are arranged to each other in a cross manner, so as to increase the number of contact points between the first spacer **131d** and the second spacer **132d**. Thus, when the liquid crystal panel **10** is impacted by external force, the tight abutment between the first spacer **131d** and the second spacer **132d** of the spacer structure **13d** can be still maintained, so as to ensure the display quality of the liquid crystal panel **10**.

[0038] Referring now to FIG. 9, a top view of a spacer structure of a liquid crystal panel according to a sixth embodiment of the present invention is illustrated in FIG. 9. The spacer structure **13e** of the sixth embodiment of the present invention is substantially similar to the spacer structure **13b** of the third embodiment, so that the sixth embodiment uses similar terms or numerals of the third embodiment. As shown, the difference between the third embodiment and the sixth embodiment is that the end surface of the first spacer **131e** is H-shape, and the end surface of the second spacer **132e** is strip-like. Meanwhile, the end surface of the second spacer **132e** is disposed on the end surface of the first spacer **131e**, so as to increase the number of contact points between the first spacer **131e** and the second spacer **132e**. Thus, the spacer structure **13e** still can maintain the tight abutment between the

first spacer **131e** and the second spacer **132e**, so as to ensure the display quality of the liquid crystal panel **10**.

[0039] As described above, in comparison with the traditional pillar-like spacer of the liquid crystal panel which the spacers may be shifted due to external force to thus cause permanently light leakage and affect the display quality of the liquid crystal panel, the liquid crystal panel **10** of the present invention is provided with a plurality of spacer structures **13** sandwiched between the array substrate **11** and the CF substrate **12**, wherein each of the spacer structures **13** comprises: a first spacer **131** disposed on an upper surface of the array substrate **11**; and a second spacer **132** disposed on a lower surface of the CF substrate **12**, while the second spacer **132** is correspondingly abutted against the first spacer **131**. Thus, the contact range between the first spacer **131** and the second spacer **132** can be increased. When the liquid crystal panel **10** is impacted by external force, the first spacer **131** and the second spacer **132** of the spacer structure **13** can keep a tight abutment therebetween all the time, so as to ensure the display quality of the liquid crystal panel **10**.

[0040] The present invention has been described with a preferred embodiment thereof and it is understood that many changes and modifications to the described embodiment can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

1. A liquid crystal panel, characterized in that: the liquid crystal panel comprises:

an array substrate having an upper surface provided with a plurality of first spacers; and

a color filter substrate disposed on the array substrate, wherein a lower surface of the color filter substrate is provided with a plurality of second spacers, and each of the second spacers is correspondingly abutted against one of the first spacers.

2. The liquid crystal panel according to claim 1, characterized in that: the area of an end surface of the first spacer is not equal to the area of an end surface of the second spacer, and the end surface of the second spacer is abutted against the end surface of the first spacer.

3. The liquid crystal panel according to claim 1, characterized in that: an end surface of the first spacer is grid-like or strip-like, while an end surface of the second spacer is corresponding strip-like or grid-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

4. The liquid crystal panel according to claim 1, characterized in that: an end surface of the first spacer and an end surface of the second spacer are strip-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

5. The liquid crystal panel according to claim 1, characterized in that: the end surface of the first spacer is H-shape, and the end surface of the second spacer is strip-like, wherein the end surface of the second spacer is disposed on the end surface of the first spacer.

6. A spacer structure of a liquid crystal panel, sandwiched between an array substrate and a color filter substrate for correspondingly constructing a liquid crystal panel, the spacer structure of the liquid crystal panel being characterized in that: each of the spacer structure comprises:

a first spacer disposed on an upper surface of the array substrate; and

a second spacer disposed on a lower surface of the color filter substrate, wherein the second spacer is correspondingly abutted against the first spacer.

7. The spacer structure of the liquid crystal panel according to claim 6, characterized in that: the area of an end surface of the first spacer is not equal to the area of an end surface of the second spacer, and the end surface of the second spacer is abutted against the end surface of the first spacer.

8. The spacer structure of the liquid crystal panel according to claim 6, characterized in that: an end surface of the first spacer is grid-like or strip-like, while an end surface of the second spacer is corresponding strip-like or grid-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

9. The spacer structure of the liquid crystal panel according to claim 6, characterized in that: an end surface of the first spacer and an end surface of the second spacer are strip-like, wherein the end surface of the first spacer and the end surface of the second spacer are arranged to each other in a cross manner.

10. The spacer structure of the liquid crystal panel according to claim 6, characterized in that: the end surface of the first spacer is H-shape, and the end surface of the second spacer is strip-like, wherein the end surface of the second spacer is disposed on the end surface of the first spacer.

* * * * *

专利名称(译)	液晶面板及其隔离结构		
公开(公告)号	US20130010238A1	公开(公告)日	2013-01-10
申请号	US13/264145	申请日	2011-08-04
[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
[标]发明人	CHEN YA HUI CHANG TSUNGLUNG		
发明人	CHEN, YA-HUI CHANG, TSUNGLUNG		
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其他公开文献	US9298045		
外部链接	Espacenet USPTO		

摘要(译)

本发明公开了一种液晶面板及其隔离结构。液晶面板具有：阵列基板，滤色器基板，以及夹在阵列基板和滤色器基板之间的多个间隔物结构。每个间隔物结构具有：第一间隔物，设置在阵列基板的上表面上；第二间隔物设置在滤色器基板的下表面上。第二间隔件相应地抵靠第一间隔件。因此，当液晶面板受到外力冲击时，第一隔离物和第二隔离物可以在它们之间保持紧密邻接，从而确保液晶面板的显示质量。

